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Effect of conservation tillage and weed management practices on yield and yield attributes of wheat (*Triticum aestivum* L.)

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Abstract
An experiment on "Effect of conservation tillage and weed management practices on yield and yield attributes of wheat (*Triticum aestivum* L.)" was conducted at the shradhay Bhagwati Singh Agriculture Research farm, Hazipur, Chandra Bhanu Gupt Krishi Mahavidyalaya, B.K.T., Lucknow (U.P.) during *Rabi* Season of 2022-23 The experiment was laid out in split plot design (SPD) with conversation tillage and four weed control practice. Results revealed that among tillage practices crop received zero tillage + residue and in weed management practices Sulfosulfuron 75% WP @ 24 g a.i./ha found significantly superior respect to yield and yield attributes.

Keywords: Conservation tillage, weed management practices, yield, yield attributes, *Triticum aestivum* L.

Introduction
Wheat Tillage influences soil bulk density, penetration resistance, aggregate mean weight diameter and surface roughness (Carman, 1996) [1]. Therefore, the changes in mechanical characteristics of the seedbed due to tillage can influence the crop and weed emergence. Tillage affects weed seed distribution in soil profile (Pareja *et al*., 1985; Yenish *et al.*, 1992, 1996) [2, 3-4] and the differential distribution of the seed in soil profile has the potential to change weed population dynamics (Buhler, 1991, 1995, 1997; Froud-Williams *et al.*, 1983; Harper, 1957) [5-7, 9, 10]. It also affects soil properties, such as organic matter, microbial populations, soil moisture, temperature and pH (Blevins *et al.*, 1983) [11], which can affect herbicide activity by influencing herbicide adsorption, movement, persistence and efficacy.
Conservation tillage (CA) provides excellent soil fertility and also saves money, time and fossil-fuel. It is an efficient alternative to traditional agriculture, attenuating its drawbacks. Conservation agriculture aims at reversing the process of degradation inherent to the conventional agricultural practices like intensive agriculture, burning/removal of crop residues.
The presence of weeds within the crop may adversely affect production in a number of ways. Weeds compete with crop species for water, nutrients and light and ultimately reduce crop yield. Weeds are unwanted plant species growing in the domesticated crops. The competition of weeds for nutrients may results in such obvious responses as dwarfing in plant size, nutrient starved conditions, wilting and actual dying out of plants. Weeds are notorious yield reducers that are, in many situations, economically more important than insects, fungi or other pest organisms. Weeds not only reduce the crop yield, but also deteriorate the quality of the produce thereby, reducing its market value. Weeds reduce yield by affecting the sunlight reaching the plants. In some more serious cases it may lead to complete failure of crop (Mishra *et al*. 2021; Mishra *et al*. 2023) [14, 15]. Therefore, the eradication of weeds from the crop fields is essential for obtaining maximum returns.

Methodology
The experiment was carried out during Rabi 2022-23 at Shradhay Bhagwati Singh Agriculture Research Farm, Hajipur, Chandra Bhanu Gupta Krishi Mahavidyalaya, B.K.T., Lucknow (U.P.).

The field was well leveled having good soil condition. In order to determine the physico-chemical characteristics of experimental plot a soil sample was collected from different places at random with the help of soil auger to a depth of 0-15 cm prior to application of fertilizers. The soil sample representing the whole field was taken and analyzed in laboratory for physico-chemical properties. The experiment was laid out in split plot design (SPD) with conversation tillage and four weed control practice with combination of 12 treatment and replicated three times. The treatments were allotted randomly to various main plots and sub plots.

Results and Discussion

The data recorded on various yield attributes were subjected to statistical analysis and are condensed in table. A critical scruiting of data printed in table 1 revealed that all yield attributes were affected satatistically due to tillages practices and weed management treatments.

Crop received zero tillage + residue (T_3) gave significantly maximum tillers (363.62), Length of spike (10.76 cm), grains/spike (70.78), grain weight/spike (2.95 g) and 1000 grain weight (41.30 g) over zero tillage treatment (T_2) and conventional tillage (T_3). The lowest values of all yield attributes were observed when wheat crop was sown in conventional tillage.

The higher values of all yield attributes with zero tillage + residues (T_3) might be due to higher availability of moisture, plant nutrient owing to lesser population of weeds, which enhanced the photosynthetic activity and synthesized higher amount of photosynthetic which were trans located to reproductive parts of plant frequently hence, higher values of yield attributes wee obtained. Contrary to this, due to exposure of weed seeds under conventional tillage, recorded higher weed population and its dry matter resulted higher crop weed completion, and lesser availability of plant nutrients caused significant reduction in photosynthetic activity of plant and synthesis of lesser amount of photosynthetic reduces the yield attributes considerably similar higher value of yield attributes were reported.

Table 1: Yield attributes or affected by conservation tillage and weed management practices and yield of wheat

Treatments	Days after sowing (DAS)				
	No of Effective tillers/m^2	Length of spike (cm)	Grain/spike	Grain weight/spike (g)	Test wet
Tillage Practices					
Conventional tillage (CT)	315.10	9.43	60.70	2.48	38.30
Zero tillage (ZT)	348.26	10.37	61.66	2.75	40.10
Zero tillage + residue (ZTR)	363.62	10.76	70.78	2.95	41.30
SEm±	1.80	0.25	1.12	0.07	0.21
CD (P=0.05)	4.90	0.74	3.33	0.17	0.62
Weed management					
Weedy check	210.00	9.40	55.70	2.39	37.10
Metsulfuron 20% WP @ 20 g a.i./ha (PoE)	370.62	10.89	60.10	2.90	40.10
2,4-D @ 38 @ EC @ 0.8 kg a.i./ha (PoE)	352.29	10.74	66.92	2.88	39.10
Sulfosulfuron 75% WP @ 24 g a.i./ha	374.50	10.92	71.10	2.94	41.50
SEm±	1.60	0.32	0.07	0.15	0.22
CD (P=0.05)	4.81	1.02	0.21	0.41	0.66

Turning to the affect of weed management on different yield attributes reveald that the highest value of yield attributes were recorded with post emergence spray of susfosulfuron followed by metsulfuron was mainly attributed to efficient control weeds reduced the crop weed completion and higher availability nutrients to plants makes it higher photosynthesis and photosynthetic which were trans located to reproductive parts of plant and makes the healthy yield attributes.

However, poor efficiency of control of weeds, under 2,4 -D applied treatment resulted higher crop weed competition reduced the amount of photosynthesis and its translocation to reproductive parts of pants hence, poor development of yield attributes was recorded.

On the other hand, heavy crop weed completion under weedy check treatment resulted significant reduction in availability of nutrients and moisture caused poor synthesis of photosynthesis and its translocation to pant system which resulted in poor development of yield attributes similar results were reported by Singh *et al.,* (2011) [16], Shehzad *et al.,* (2012) [17], Singh *et al.,* (2017) [18], Ashok *et al.,* (2022) [19].

Yield

The data on grain yield, straw yield, biological yield and harvest index (%) was recorded at harvest were analyzed statistically and presented in table 2. A perusal of the data indicated that different tillage practices and weed management affected the grain, straw and biological yield and harvest index statistically. An examination of data presented in table 3 revealed that crop sown with zero tillage + residue (ZTR) being at par with zero tillage (T_2) for grain yield and harvest index but produced significantly higher straw yield and total biological yield over both i.e. zero tillage (T_2) and conventional tillage (T_2). The percent increase in yield due to zero tillage + residue (ZTR) was recorded to the tune of 5.14 and 16.22 over zero tillage (T_2) and conventional tillage (T_1) respectively. The higher yield under zero tillage + residue (ZTR) and zero tillage (ZT) over conventional tillage (CT) was mainly due to higher values of yield attributes like effective tillers, spike length, no. of grain/spike, weight of spike and 1000 grain weight, as grain and straw yield the function of growth and yield attributes which were significantly contributed towed the higher grain and straw yield.

Table 3: Yields and Harvest index (%) as affected due to tillage practices and weed management practices

Treatments	Days after sowing (DAS)			
	Grain yield (q/ha)	Straw yield (q/ha)	Total Biological yield (q/ha)	Harvest index (%)
Tillage Practices				
Conventional tillage (CT)	35.50	67.75	103.25	34.38
Zero tillage (ZT)	40.39	74.80	115.19	35.06
Zero tillage + residue (ZTR)	42.47	77.93	120.40	35.27
SEm±	0.92	0.85	1.50	0.36
CD (P=0.05)	2.73	2.55	4.55	1.09
Weed management				
Weedy check	27.15	54.91	82.06	33.08
Metsulfuron 20% WP @ 20 g a.i./ha (PoE)	42.23	78.15	120.38	35.08
2,4-D @ 38 @ EC @ 0.8 kg a.i./ha (PoE)	37.10	69.90	107.00	34.67
Sulfosulfuron 75% WP @ 24 g a.i./ha	43.09	78.10	121.19	35.55
SEm±	0.96	1.10	1.15	0.40
CD (P=0.05)	2.88	3.35	3.45	1.22

Contrary to this, poor values of yield attributes under conventional tillage treatment was mainly responsible for lower grain and straw yield. Harvest index was improved with zero tillage + residue (T_3) and zero tillage (T_2) over conventional tillage indicate the higher proportion of grain yield as compared to biological yield. Hence, higher harvest index was observed in zero tillage + Residue (ZTR) as compared to conventional tillage (CT) treatment.

Conclusion

In conclusion, the experiment conducted at Shradhay Bhagwati Singh Agriculture Research Farm provided valuable insights into the effects of different tillage and weed management practices on wheat yield attributes. Results demonstrated that zero tillage with residue management significantly enhanced various yield attributes, including tiller count, spike length, grains per spike, grain weight per spike, and 1000 grain weight, leading to improved overall grain and straw yields. Conversely, conventional tillage resulted in poorer yield attributes and lower yields. Efficient weed management, particularly with sulfosulfuron and metsulfuron, further boosted yields by reducing weed competition and enhancing nutrient availability for plants. The findings underscore the importance of conservation tillage and effective weed management strategies in optimizing wheat productivity.

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